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SPECIFICATION TITLE OF THE INVENTION

MOBILE COMMUNICATION SYSTEM AND APPARATUS CONSTITUTING SAME

BACKGROUND OF THE INVENTION

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This invention relates to a mobile communication system in which a communicating party is authenticated when communication is performed between a mobile terminal and a device on the side of a network, and to an apparatus constituting this system. More particularly, the invention relates to a mobile communication system in which, when a signal requesting execution of a prescribed operation is received from a device on the side of a network, whether the device on the network side is an authorized device is authenticated at a mobile terminal, and to an apparatus constituting this system.

Various authentication methods in mobile communication systems have been proposed. For example, Japanese Patent Application Laid-Open No. 10-336744 discloses an authentication technique whereby the validity of a mobile station that has attempted to place a call is authenticated on the side of the base station. According to this prior art, (A) when a call starts to be originated from a mobile station to a base station, (B) the base-station side transmits to the mobile station a first random number that specifies one code key number among a plurality (N-number) of shared code key numbers. (C) From the first random number received the base-station side, the mobile station identifies one code key number from among a plurality (N-number) of code key numbers and sends the basestation side a second random number representing this code key number. (D) The base-station side compares the code key number identified by the second random number transmitted from the mobile-station side and the code key number specified by the first random number, and the base station verifies that the mobile station that attempted to originate the call is authentic only if the two code key numbers match.

Further, an authentication technique for checking the authenticity of a base station on the side of a

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mobile station has been disclosed in the specification of USP 5.282.250 (January 25. 1994).
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base station regardless of user intentions does not pose a problem so long as the requesting base station is an authorized base station based upon an agreement with the user. If the requesting base station is a malicious base station, however, this does pose a problem because there is the danger that implementation of communication will be obstructed wrongfully or that terminal information concerning the mobile station or personal information set by the user will be used secretly.

SUMMARY OF THE INVENTION

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Accordingly, an object of the present invention is to so arrange it that when a request to execute a prescribed operation is received from a device on the side of a network, control is exercised to execute or not execute the operation in accordance with the request upon checking, on the side of the mobile station, whether the request was issued by an authorized device on the network side.

Another object of the present invention is to so arrange it that control for executing an operation is carried out on the side of a mobile station upon distinguishing between a request requiring authentication as to whether a network device that issued the request is an authorized network device, and a request not requiring such authentication.

Another object of the present invention is to so arrange it that implementation of a communication service will not be obstructed wrongfully and so that terminal information concerning a mobile station or personal information set by a user will not be used secretly.

A mobile communication system for authenticating a communicating party when communication is performed between a mobile terminal and a device on the side of a network, wherein (1) the mobile terminal, upon receiving a signal requesting execution of a prescribed operation from the network device, sends the network device an authentication request signal in order to determine whether the operation-execute request signal is a request signal from an authorized network device, and performs an authentication operation; (2) the

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terminal: any random number:
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authentication operation performed by the network device; and ⑥ a comparator for comparing result of the authentication operation performed on the side of the mobile terminal and result of the authentication operation sent from the network device; it being decided that the request is one from an authorized network device when the compared results agree.

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The network device includes (1) means for sending a mobile terminal a request signal requesting execution of an operation; (2) a table for storing correspondence between an identifier and key information of a mobile terminal; (3) a receiver for receiving, from a mobile terminal that has received the request signal requesting execution of an operation, an authentication request signal that includes the identifier and random number of this mobile terminal; (4) a key-information acquisition unit for acquiring key information, which corresponds to the received identifier of the mobile terminal, from the table; and (5) an authentication operation unit for executing an authentication operation using the key information acquired from the key-information acquisition unit and the random number included in the authentication request signal received from the mobile terminal, and sending result of the authentication operation to the mobile terminal.

Thus, in accordance with the present invention, when a request to execute a prescribed operation is received from a network device, and control is exercised to execute or not execute the requested operation upon checking, on the side of the mobile station, whether the request was issued by an authorized network device.

Further, in accordance with the present invention, control for executing an operation can be carried out on the side of a mobile station upon distinguishing between a request requiring authentication as to whether a network device that issued the request is an authorized network device, and a request not requiring such authentication.

Further, in accordance with the present invention, it can be so arranged that implementation of a communication service will not be obstructed wrongfully,

and terminal information concerning a mobile station or personal information set by a user will not be used secretly, owing to a request from an unauthorized network device.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is a diagram useful in describing the principle of the present invention;

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- Fig. 2 is a diagram useful in describing an authentication principle in a mobile station and network device:
- Fig. 3 is a diagram showing the structure of a network device according to a first embodiment;
- Fig. 4 is a diagram showing the structure of a mobile station according to the first embodiment;
- Fig. 5 is a flowchart of authentication processing according to the first embodiment;
 - Fig. 6 is a diagram showing the structure of a mobile station according to a second embodiment of the present invention;
- Fig. 7 is a diagram showing the structure of a mobile station according to a third embodiment of the present invention;
 - Fig. 8 is a diagram showing the structure of a mobile station according to a fourth embodiment of the present invention:
 - Fig. 9 is a diagram showing the structure of a mobile station according to a fifth embodiment of the present invention;
- Fig. 10 is a diagram showing the structure of a mobile station according to a sixth embodiment of the present invention;
 - Fig. 11 is a diagram showing the structure of a mobile station according to a seventh embodiment of the present invention;
- Fig. 12 is a diagram showing the structure of a mobile station according to an eighth embodiment of the present invention;
- Fig. 13 is a flowchart of authentication processing in a mobile station according to the eighth 40 embodiment; and
 - Fig. 14 is a diagram useful in describing the prior art in a case where a base station requests a

halt to emission of radio waves from a mobile station.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

(A) Principle of the present invention Fig. 1 is a diagram useful in describing the principle of the present invention, in which a mobile station (mobile terminal) 11 and network device 12 communicate with each other via a mobile network. network device 12 sends the mobile station 11 a signal (request signal C) requesting execution of a prescribed operation, whereupon the mobile station 11 sends an authentication request signal, which is for checking the authenticity of the network device 12, back to the network device. The network device 12 executes an authentication operation based upon the authentication request signal sent back, creates an authentication answer signal (result of authentication operation) and The mobile sends the signal to the mobile station 11. station 11 checks the content of the authentication answer signal (result of the authentication operation), decides that the network device is an authorized network device only if the content of the authentication answer signal authentic information, and executes the operation that is in accordance with the request signal C.

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Further, if a request signal requiring 25 authentication as to whether a network device is an authorized network device and a request signal not requiring such authentication exist, the mobile station 11 checks to determine whether the request signal C received from the network device is a request signal 30 requiring authentication. If authentication is required, the mobile station 11 executes authentication processing, executes the operation that is in accordance with the request signal C if authentication that the network device is an authorized network device 35 is obtained, and does not execute the operation that is in accordance with the request signal C if the network device is not an authorized network device. Further, if the request signal C is not one requiring 40 authentication, then the mobile station 11 foregoes authentication processing and executes the operation that is in accordance with the request signal C.

Fig. 2 is a diagram useful in describing authentication processing in a mobile station and network device.

The network device 12 sends the mobile station 11 a signal (the request signal C) requesting execution of a prescribed operation. Upon receiving the request signal C, the mobile station 11 reads identifier information (ID), which is for identifying itself, out of a mobile-station identifier storage unit 31, and sends the network device 12 an authentication request signal (ID, R) that contains the identifier information (ID) and a random number (R), which has been generated by a random-number generator 33. Further, an authentication operation unit 34 of the mobile station 11 performs an authentication operation using key information (K), which is held in a key-information holding unit 32, and the random number (R), and generates an authentication result (X).

On the other hand, the network device 12 sends the received identifier information (ID) to a home memory 23 whence it obtains key information (K) identical with that being held by the mobile station 11. authentication operation unit 22b performs an authentication operation similar to that of the authentication operation unit 34 using this key information (K) and the random number (R) received, and generates an authentication result (X'). The network device 12 sends the authentication result (X') to the mobile station 11, and a comparator 39 in the mobile station 11 that has received the authentication result compares the authentication results (X) and (X'). answer execution unit 51 performs an answer operation in accordance with the request signal C only if the two authentication results agree.

(B) First embodiment

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Figs. 3 and 4 are diagrams showing the structures of a network device and mobile station, respectively, according to the first embodiment, and Fig. 5 is a flowchart of authentication processing according to the first embodiment.

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23 is provided with a key-information

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The home memory that stores a corresponding unit and holding 
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that stores a corresponding that stores a carrier identifies that monite at ation identifies holding unit hetween monite at ation identifies that helding anin hetween monite at ation and the holding that he were monite at a tion and the holding that he were monite at a tion and the holding that he were monite at a tion and the holding that he were monite at a tion and the holding that he were monite at a tion at a t
                                                                                                                                                                                                                                                                                                                         relationship between mobile station identifiers has upon receiving and key information upon receiving telephone numbers) the mobile stations.
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station 21 in whose attain requests resides.
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target of the larget the target mobile station.
                                                                                                                                                                                                                                                                                                                                                                                                                                                    station of the operation recommendation of the area the mobile station resides.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         transmitter 21a of the base station 21 transmitter 21a of the target mobile are of right transmitter 21a to the target right give of right request signal to an are request flower art on the right request flower art on the right requests.
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       ost signal to the target module station.

The flowchart on network device

The flow of the network device
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      Processing flow the network, the control base station the network, to to the base station a request the request signal c
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              a request from the network, the control station 22 at the target of the pase station that is the target of target of the target of target of the target of target 
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transmits area requests resides.

the whose area requests resides.
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The flowchart on the network the control the network t
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       in whose area the mobile station and the request signal C to the operation station 21 sends the target of the base station 21 sends the request signal C to
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  request signal C, the mobile station request signal (ID, the mobile station identifier identifier network contains the mobile-station identifier
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 the mobile station 11 (step 101). Upon receiving the mobile station the mobile station request signal C, the authentication request request network device
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                of the base station 11 (step 101).
the mobile station the mobile stati
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       information ID and random number R. R) is received, the signal information ID request signal station 21 sends this signal authentication of the base receiver 21b of
                                                                                                                                                                                                                                                                                                                                                                                                                                      25
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       authentication request signal (ID, R) is received, the nome memors authentication the base station 102).

authentication factor the base station 22 (sten to the control station to the
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            receiver 21b of the base station 102). 22 acquires ation to the mobile station to the mobile station to the mobile station to the mobile controller to the controller controller information key information.
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controller 22a of the corresponding the key-information

key information the key information information information information the key information the key information the key information information the key information the key
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nolding unit 23a and inputs this information to the and inputs this information the and inputs the
                                        authentication operation unit 22b (step 103). The prescribed unit 22b (step 103). The prescribed authentication operation unit 22b executes a number R and unit 22b executes number R and 
                       nolding unit 23a and imputs this information to authentication operation unit 22b executes a suther transfer of auther transfer
                                                                authentication operation using the random the authentication information k contained in the acquired key information information information k contained key information k contained k con
                                                                                                            acquired key information result X' to the mobile station result X' to authentication result authentication result x' authentication result x' to the mobile station result x' to the mobile st
                                                                                                                                authentication result x' to station (step 105).

authentication result the base station (step 105).
                                                                                       authentication operation K contained in the authentication information K contained in the acquired key information acquired key information remnest eignal leter in a acquired her in a remnest eignal acquired her in a remnest eignal
                                                                                                                                                    authentication result X' to the mobile station V

the base station (step 105).

authentication result X' to the base station (step 105).
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mobile station (mobile-station identifier (e.a..

mobile station mobile-station identifier (e.a..

includes the mobile-station identifier (e.a..
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       The mobile station
                                                                                                                                                                                                                                                                          storing the mobile-station identifier (e.g., 32 storing the mobile-station holding unit to the key-information has been assigned to the number) information K that has been the key information the key information the key information information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been assigned to the key information K that has been as a contain the key information K that has been as a contain the key information K that has been as a contain the key information K that has been as a contain the key information the key inform
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                                                                                                                                                                                                                 rig. 4 is a diagram snowing in mobile station mobile
                                                                                                                                                                                                                                                                                                  number) ID; the key-information holding unit 32 stori
the key-information holding unit 32 stori
the key information K that has been assigned 33 for
the key information; the random number denerator 33 for
the key station;
                                                                                                                                                                                                                                                                                                                   the key information K that has been assigned to the random number generator 33 for authentication the random number R: the authentication mobile station; random number R:
                                                                                                                                                                                                                                                                                                                                       mobile station; the random number R; a prescribed authentication the random number R; a prescribed the key information generating unit 34 for executing the key information operation unit operation using authentication operation unit authentication unit authentication operation unit authentication unit authenticatio
                                                                                                                                                                                                                                                                                                                                                                                operation unit 34 for executing a prescribed information K signal creation using the key signal creation operation authentication signal creation authentication number R; an authentication authentication authentication authentication signal creation authentication signal creation authentication signal creation authentication authentication authentication authentication authentication signal creation authentication signal creatication signal creation authentication signal creation signal 
                                                                                                                                                                                                                                                                                                                                                                                                       authentication number R; an authentication request signal and random number the authentication request signal the authentication request signal and random number R; the authentication request signal the authentication request signal and random number R; the authentication request signal authentication req
                                                                                                                                                                                                                                                                                                                                                                                                                        and random number R; an authentication identifier ID and unit R) containing the mobile station identifier ID.
                                                                                                                                                                                                                                                                                                                                                                                                                                             unit 35 for creating the authentication identifier ID and the mobile-station sending the mobile-station sending the (ID, number R; a transmitter and number R; a transmitter and number R;
                                                                                                                         10
                                                                                                                                                                                                                                                                                                                                                                                                                                                                 (ID, R) containing the mobile-station identifier us transmitter 36 for sending transmitter (ID, R) and other us random number R; a transmitter signal (ID, R) and other random random request signal (ID, R)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     random number R; a transmitter (ID, R) and other user (ID, 37 for turning the authentication; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station; a switch 37 for turning the authentication pase station pa
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             authentication request signal (ID, R) and other user the authentication request signal (ID, 37 for turning for receiver 38 for receiver 38 for receiver data to the base station; a receiver a receiver data to signal on and off; a receiver data to signal on and off;
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 data to the base station; a switch a receiver as received a request signal C from the transmit signal station; the from the transmit base station.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     transmit signal on and off; a receiver 38 for receiving the the side, the authentication result X, from the from the side, network side,
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       network side and other transmit result x computed on network side the authentication result x computed for comparation
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                controller 40 for exercising overall control for the mobile station the comparison is a controller to the mobile result of the comparison authentication of the the result of the result of the comparison is a controller to the result of the comparison is a controller to the result of the comparison is a controller to the result of the comparison is a controller to the result of the comparison is a controller to the comparison is a controller to the result of the comparison is a controller to the controller to th
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               result X' sent from the base station 21; and a for the base overall libased upon the total station 11 based upon the mobile station 11 based upon the mobile station at the mobile station of the mobile station in the mobi
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 the mobile station the comparison that the the that the network head of the retwork and the station that are the the that the network and the stational that the 
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         request signal C. 37 judges signal C is authorized and transmitted the request signal c is authorized to request signal c is authorized.
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The flowchart on monile station.
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      processing flow of the mobile station. device 12 (step the request signal c from the network device)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           request signal C.
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201), the mobile station, under the control of the controller 40, reads the mobile-station identifier ID out of the mobile-station identifier storage unit 31 and inputs the ID to the authentication signal 5 generator 35. Further, the random-number generator 33 generates the random number R under the control of the controller 40 and inputs the random number to the authentication operation unit 34 and authentication signal generator 35 (step 202). The authentication signal generator 35 creates the authentication request 10 signal (ID, R) containing the mobile-station identifier ID and random number R and transmits this signal to the network device 12 via the transmitter 36 (step 203). Further, the authentication operation unit 34 executes 15 a prescribed authentication operation using the key information K, which is being held in the keyinformation holding unit 32, and the random number R, and inputs the authentication result X to the comparator 39 (step 204). If the authentication result 20 X' is received from the network device 12 (step 205), comparator 39 compares the authentication result X computed on the side of the mobile station and the authentication result X' sent from the network device If X = X' does not hold, it is decided (step 206). 25 that the network device is unauthorized and the operation conforming to the request signal C is not executed. If X = X' holds, however, it is decided that the network device is authorized and the comparator inputs an OFF signal to the switch 37. In response, 30 the switch 37 halts the input of the transmit signal, which is output from the transmitter 36, to the antenna ATN, thereby halting the transmission of radio waves (step 207).

(c) Overall authentication processing

The network device 12 sends the mobile station 11
the signal (request signal C) requesting a halt to
transmission of radio waves. For example, if the owner
of the mobile station 11 performs a remote control
operation to halt the radio waves transmitted from the
mobile station, a request signal arrives at the control
station 22 via a public telephone network. The control
station transmits the request signal to the base

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station 21 in whose area the mobile station 11 that is the target of the operation request resides, and the base station 21 sends the request signal C to the mobile station 11 from the transmitter 21a.

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When the signal (request signal C) requesting halt of radio-wave emission is received from the network device 12, the controller 40 in the mobile station 11 recognizes the signal via the receiver (RX). Though the operation of various components within the mobile station 11 is thenceforth controlled by the controller 40, the individual control signals for implementing such control are not shown in the drawings.

Next, in order to transmit the authentication request signal (ID, R) from the mobile station 11 to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device via the transmitter 36. Further, the authentication operation unit 34 performs the authentication operation using the key information (K), which is being held by the key-information holding unit 32, and the random number (R), and generates the authentication result (X).

On the other hand, the network device performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via

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the receiver 38 and the authentication operation unit 34 to computed by the authentication operation.
                   the receiver 38 and the authentication operation to the switch the receiver the authentication is sent to the computed by the OFF signal, which is sent to the generates
                                      computed by the authentication of is sent to the authentication of is sent to results agree only if the two results agree on the two results agree of the two results agree on the two results agree of the two results agree on the two results agree of the two results agree on the two results agree on the tw
                                                       generates the OFF signal, which is sent to the switch results agree.

generates the off signal, only if the two execute mobile station execute

transmission, mobile station execute

and to make the having the mobile station.
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                                                                                                                    authentication processing on the side of the mobile authentication processing on the authentication processing authentication processing authentication processing on the side of the mobile
                                                                                                 Thus, by having the mobile station executed with existing identical with a network de authentication processing executed in a network authentication authenticatio
                                                                                                                                        authentication processing on the side of the mobile suthentication processing on the using a special authentication processing on the side of the mobile authentication processing on the side of the mobile side of the side of the mobile side 
                                                                                                                                                           authentication processing on the side of the mobile set-
authentication be implemented without using a special station can be implemented without using a special set-
                                                                                                                                                                                                                                                                                                                    (C) Second embodiment illustrating the structure of embodiment of embodiment to a second embodiment of fig. 6 is a according to a second embodiment of a second embodiment of station according to a second embodiment of a second embodiment of a second embodiment of second embodiment of a second embodiment of a second embodiment of a second embodiment of second embodiment of a second embodi
                                                                                                                                                                                                                                         Fig. 6 is a diagram illustrating the structure of to a second embodiment with the structure of the second embodiment of illustrating to a second embodiment identical with the station according to a components identical with the present invention.
                                                                                                                                                                                                                                                             a mobile station according to a second embodiment in the present the mobile station of the those of the mobile station.
                                                                                                                                                                                                                                                                                   the present invention. Here components the mobile station of the reference characters.

the present invention at the mobile station of the reference characters.

those of the mobile are designated by like reference characters.
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Like roace where the first embodiment the station of the first embodiment the first embodiment relates to a case where the first embodiment relates
                                                                                                                                                                                                                                                                                                                       Fig. 4 are designated by like reference where sign are designated by like to a case where sign are mobile station a sign where the mobile station as a sign where the mobile station a sign where the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile station as a sign where the mobile station are the mobile stat
                                                                                                                                                                                                                                                                                                                                       The first embodiment relates to a case where signal waves.

The first embodiment relates mobile station waves.

The first device 12 sends transmission of radio waves.

The reducesting a halt to transmission of radio waves.
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The mobile station a signal of radio waves.

The mobile of radio waves.

The mobile of radio waves.

The mobile station a signal of radio waves.

The mobile of radio waves.

                                                                                                                                                                                                                                                                                                                                                                                     requesting a halt to transmission of radio waves. In which a signal to transmission of transmission is second embodiment, of a radio wave transmission is second embodiment, of a radio wave transmission is requesting release of a radio wave transmission is second embodiment, of a radio wave transmission is second release of a radio wave transmission is second release of a radio wave transmission is second embodiment.
                                                                                                                                                                                                                                                                                                                                                                                                     second embodiment, however, is one in which a signal sent transmission of radio transmis
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                                                                                                                                                                                                                                                                                                                                                                                                                        requesting release of a radio. wave transmission of radio transmission of that the noted that the requesting release of a which transmission of that the requesting release of a which transmission of that the noted that the noted that the waves has been halted.
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To a mobile been halted.

Waves has and operation of the network device in the waves and operation of the network device in the networ
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   structure and operation of the network and are not described the modiment are embodiment and are of the first embodiment and a
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second embodiment embodiment also in third to elanth

device of the same is true also are the same is true are the same is true also are the same is true are the same are the same as those of the network are those of the network are those not described are those not described are the same as those not described to elanth.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               Timents below. It station li whose emission of radio the network the mobile station a request from the network when halted by a request from the network the mobile station as request from the network t
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    When the mobile station 11 whose emission of rac from the network from the network a request signal () from waves has been halted a signal (request signal from the network as a signal from the mobile station and from the network from the networ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       waves has been halted by a request signal (request some of emission of emission of a resumption of emission emi
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    device 12 receives a signal (request signal c) from of the request the request the recognizes the request network waves.
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           network device the controller 38 and thenceforth control radio waves, the receiver 38 and through the receiver 38 and the receiver 38 and the receiver radio waves, the receiver 38 and the receiver radio waves, the receiver radio waves radio waves, the receiver radio waves radio waves, the receiver radio waves radio
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  radio waves, the receiver 38 and thenceforth controls operation of the mobile signal through overall authentication operation.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     signal through the receiver as and thenceforth continuous the receiver as and thenceforth mobile to the mobile the mobile the mobile the property of the mobile the signal through the request signal (C) is input also to the overall authentication and the request signal the station.
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       embodiments below.
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                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                comparator 39, which inputs the ON signal to the transmission (radio-wave transmission) transmission)
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   37 in order to perform transmit the authentication to perform transmit the authentication to the network device 12, the network device 12
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       Next, in order to transmit the authentication the network device is read or the network (ID) is read or the networ
                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              request signal (ID, R) to the network device 12, the out information (ID) is read out information (ID) is read out
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of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device via the transmitter 36. Further, the authentication operation unit 34 performs the authentication operation using the key information (K), which is being held by the key-information holding unit 32, and the random number (R), and generates the authentication result (X).

On the other hand, the network device 12 performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and generates the OFF signal, which is sent to the switch 37 to halt transmission, only if it is detected that the two results do not agree. If the two results do agree, the comparator continues to output the ON signal, which is already being output. As a result, operation for releasing the radio-wave transmission is completed.

Thus, by having the mobile station execute authentication processing identical with existing authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special setup.

(C) Third embodiment

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Fig. 7 is a diagram illustrating the structure of

a mobile station according to a third embodiment of the present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters.

The third embodiment relates to a case where a request signal for cutting off the power supply of the mobile station 11 is received.

When the mobile station 11 receives a signal (request signal C) from the network device 12 requesting cut-off of the power supply, the controller 40 recognizes the request signal through the receiver 38 and thenceforth controls the overall authentication operation of the mobile station.

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Next, in order to transmit the authentication 15 request signal (ID, R) to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request 20 signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device 12 via the transmitter 36. Further, the authentication operation unit 34 performs the authentication operation using the 25 key information (K), which is being held by the keyinformation holding unit 32, and the random number (R), and generates the authentication result (X).

On the other hand, the network device 12 performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via

the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and outputs the OFF signal to a switch 42 only if it is detected that the two results agree, thereby halting supply of power from a power supply (BAT) 41 to the entire apparatus or to some of the circuits of the apparatus. The foregoing relates to a case where cutoff of the power supply is requested. However, control can be performed in similar fashion also in a case where the mobile station is made to transition to a standby operation.

Thus, by having the mobile station execute authentication processing identical with existing authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special setup.

(E) Fourth embodiment

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Fig. 8 is a diagram illustrating the structure of a mobile station according to a fourth embodiment of the present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters. The fourth embodiment relates to a case where a signal requesting read-out of terminal information is received.

When the mobile station 11 receives a signal (request signal C) from the network device 12 requesting transmission of terminal information, the controller 40 recognizes the request signal through the receiver 38 and thenceforth controls the overall authentication operation of the mobile station.

Next, in order to transmit the authentication request signal (ID, R) to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device 12 via the transmitter 36. Further, the authentication operation

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key informs the authentication operation using the key. the key.
                                                            unit 34 performs the information the authentication operation using which is being held by the key.
                                                          the authentication result (X).

which is being held by the key.

and result (X).
                                                         and generates the authentication the random the network device 12
                                                      the On the other hand, the office of Fig. 5. Specifically, the mobile-station the mobile-station
                                                               On the the authentication result (X).

Deration indicated by the flowchart on the flowchart on the right.
                                                     side of Fig. 5.
                                                   side of Fig. 5. Specifically, the mobile station the home memory 23 to
                                                  identifier (ID)
obtain key information (K) identical with the key 23 to
                                                obtain key information is sent to the home memory the mobile with the key
                                               Obtain information (K) an authentication oberation identical with the key operation identical with that of
                                             information being held by the mobile station liss performed using the key of the
                                            an authentication operation identical with the received random number
                                          information 11 is performed using the key as transmitted to the
                                         information (K)
the authentication the received random number (R), is transmitted to the
                                    15
                                        mobile station 11.
                                    The comparator 39 of the receiver 38 and the authentication received via
                                   the received sombly the authentication result (X') received authentication operation result (X) authentication operation unit (X)
                                 the receiver 38 and the outputs a signal (ENB). Which allows transmission of
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                                computed by the outputs a signal authentication operation (INFO). to a terminal information of
                              terminal signal (ENB), which allows transmission of the two
                             terminal
holding information
results is detected. As a result. terminal information
information

information
(INFO), to a terminal terminal terminal information
information
                           holding unit as result between the terminal information holding
                          results is detected.

(INFO) is detected.

unit 43 is transmitted to the network device 12 via the
                         (INFO) being held in the terminal is transmitted to the network device 12 via the
                        transmitter 36.
                    informations information is conceivable of times used, number of
                  per day or month as time a mobile station information, outgoing-call
              30
                 per day or month, number of destination number and originator number of in case of
                incoming calls, billing information, outgoing call originator number in case of an
               incoming call.
           authentication processing identication execute in a network det
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          authentication processing identical with existing on the side of the mobile
        authentication processing executed in a network deviced in a special set of the mobile
       station can be implemented without using a special set.
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 a mobile station according to a fifth embodiment of the
          (F)
Fig. Fifth embodiment

Station according to a fifth embodiment of the
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present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters. The fifth embodiment relates to a case where a request signal for reading out user settings information, which has been set by a user, is received.

The mobile station 11 has a user-information input unit 45 that is employed by the user to input user settings information (INFO) to a user settings information holding unit 44. The user-information input unit 45 can be implemented by a key button on the mobile station or by another computer terminal connected via a connector. Content set by a user, e.g., a list (so-called telephone directory information) showing correspondence between telephone numbers and names, and a self-introductory message, such as owner name and address, is an example of the user settings information.

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When the mobile station 11 receives a signal (request signal C) from the network device 12 requesting transmission of user settings information, the controller 40 recognizes the request signal through the receiver 38 and thenceforth controls the overall authentication operation of the mobile station.

Next, in order to transmit the authentication request signal (ID, R) to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device 12 via the Further, the authentication operation transmitter 36. unit 34 performs the authentication operation using the key information (K), which is being held by the keyinformation holding unit 32, and the random number (R), and generates the authentication result (X).

On the other hand, the network device performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier

(ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and outputs a signal (ENB), which allows transmission of user settings information (INFO), to the user settings information holding unit 44 only if agreement between the two results is detected. As a result, user settings information (INFO) being held in the user settings information holding unit 44 is transmitted to the network device 12 via the transmitter 36.

Thus, by having the mobile station execute authentication processing identical with existing authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special setup.

(G) Sixth embodiment

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Fig. 10 is a diagram illustrating the structure of a mobile station according to a sixth embodiment of the present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters. The sixth embodiment relates to a case where a request signal for reading out status information of a terminal (mobile station) is received. Residual battery capacity, travelling velocity and position information, etc., are examples of status information of a terminal.

When the mobile station 11 receives a signal (request signal C) from the network device 12 requesting transmission of terminal status information, the controller 40 recognizes the request signal through the receiver 38 and thenceforth controls the overall

authentication operation of the mobile station.

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Next, in order to transmit the authentication request signal (ID, R) to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device 12 via the transmitter 36. Further, the authentication operation unit 34 performs the authentication operation using the key information (K), which is being held by the keyinformation holding unit 32, and the random number (R), and generates the authentication result (X).

On the other hand, the network device performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and outputs a signal (ENB), which allows transmission of terminal status information (INFO), to a terminal status information holding unit 46 only if agreement between the two results is detected. As a result, terminal status information (INFO) being held in the terminal status information holding unit 46 is transmitted to the network device 12 via the transmitter 36.

Thus, by having the mobile station execute authentication processing identical with existing

authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special set-up.

(H) Seventh embodiment

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Fig. 11 is a diagram illustrating the structure of a mobile station according to a seventh embodiment of the present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters. The seventh embodiment relates to a case where a request signal for reading out terminal position information as terminal status information is received. It should be noted that the structure and operation of the network device in the seventh embodiment are the same as those of the network device of the first embodiment.

The mobile station 11 has a local position detector 47 by which the mobile station 11 detects its own position. This function can be implemented utilizing a GPS (Global Positioning System), by way of example. The information representing the detected local position is stored in the terminal status information holding unit 46 as terminal status information (INFO).

When the mobile station 11 receives a signal (request signal C) from the network device 12 requesting transmission of terminal status information (position information), the controller 40 recognizes the request signal through the receiver 38 and thenceforth controls the overall authentication operation of the mobile station.

Next, in order to transmit the authentication request signal (ID, R) to the network device 12, the mobile-station identifier information (ID) is read out of the mobile-station identifier storage unit 31 and the random number (R) is generated by the random-number generator 33. The authentication request signal generator 35 generates the authentication request signal that contains the mobile-station identifier information (ID) and random number (R) and transmits this signal to the network device 12 via the

transmitter 36. Further, the authentication operation unit 34 performs the authentication operation using the key information (K), which is being held by the key-information holding unit 32, and the random number (R), and generates the authentication result (X).

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On the other hand, the network device performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

The comparator 39 of the mobile station 11 compares the authentication result (X') received via the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and outputs a signal (ENB), which allows transmission of terminal status information (INFO), to the terminal status information holding unit 46 only if agreement between the two results is detected. As a result, terminal status information (= information of the station's own position) being held in the terminal status information holding unit 46 is transmitted to the network device 12 via the transmitter 36.

Thus, by having the mobile station execute authentication processing identical with existing authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special setup.

(H) Eighth embodiment

Fig. 12 is a diagram illustrating the structure of a mobile station according to eighth embodiment of the present invention. Here components identical with those of the mobile station of the first embodiment in Fig. 4 are designated by like reference characters. The eighth embodiment is such that in a case where

there exist a request signal requiring authentication as to whether a base station is an authorized base station and a request signal not requiring such authentication, a mobile station controls execution of operation upon identifying which of these the request signal is.

In Fig. 12, the mobile station 11 has an authentication necessity table 50 storing whether or not a request signal requires authentication. For example, it is assumed that a request to halt radio-wave emission is a request not requiring authentication, and that a request to write data appended to the request signal to a memory within the mobile station is a request requiring authentication.

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Fig. 13 is a flowchart of processing useful in describing the operation of the eighth embodiment. Processing steps identical with those of the flowchart on the left side of Fig. 5 are designated by like step numbers. This flowchart differs by the addition of a step 301, which is for determining whether a request signal is one requiring authentication processing, and a step 302 which, if the request signal is one not requiring authentication, is for immediately executing the operation that is in accordance with this request signal. It should be noted that if the request signal is one requiring authentication, processing from step 202 onward is executed in a manner similar to that of the first embodiment.

If the owner of the mobile station (mobile unit)

11 performs a remote control operation to halt the
radio waves transmitted from the mobile station, a
request signal C1 arrives at the control station 22
(see Fig. 3) via a public telephone network. The
control station transmits the request signal to the
base station 21 in whose area the mobile station 11
that is the target of the operation request resides,
and the base station 21 sends the request signal C1 to
the mobile station 11 from the transmitter 21a.
Further, if the owner of the mobile station 11 performs
a remote control operation in order to rewrite
telephone directory information within the mobile
station, then a request signal C2 to which rewrite data

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(Data) has been attached arrives at the control station are work. Thereafter, in a
                                                                                                                                                                                                                (Data)

22 Via has been

Manner similar to telephone network. Thereafter station

the base in a
                                                                                                                                                                                                          22 Via Manner the public telephone station 21 sends the mobile station 11 the base request
                                                                                                                                                                                                     station 21 sends that described above the base request has been
                                                                                                                                                                                                signal 21 sends the mobile station 11 the request has been
                                                                                                                                                                                               attached.
                                                                                                                                                                                  (request signal C1) station I1 receives the network device 12. the controller
                                                                                                                                                                                                                iched.

Mien the mobile station il receives the signal raning mobile station in the raning mobile station in the signal s
                                                                                                                                                                            (request signal CI) requesting halt of recognizes the signal Via the receiver 38. Next. the
                                                                                                                                                                      emission

recognizes the signal via the receiver as anthantication h
                                                                                                                                                                 controller the signal via the receiver 38. Wext, the request is one
                                                                                                                                                             table 50, thereby to the authentication operation operation, and is one
                                                                                                                                                       table 50, thereby recognizing that the request to the swift
                                                                                                                                                  not requiring an authentication operation waves. switch 37.
                                                                                                                                              thereby halting emission of radio waves.
                                                                                                                           15
                                                                                                                                  signal controller 40
                                                                                                                                                                 When the mobile station of radio waves.

If C2 from the network device 12 remnesting request
                                                                                                                             rewriting of memory content the controller 40

remnal the receiver to the controller to the receiver the rece
                                                                                                                        rewriting of memory content.
Further, the request signal through the receiver 38.

**Recognizes of memory content.**
**Mobile station stores data (Data). which
                                                                                                                  recognizes the request signal through the receiver 38 sent with the request signal through the receiver 38 request signal through the receiver 38 request signal
                                                                                                            Purther, has been the mobile station stores data (Data), which the request form order to
                                                                                                        the authentication is completed. Next.
                                                                                                   be used a temporary storage
the controller 40 refers to the authentication is completed.
                                                                                               be used the controller the authentication is completed.

**Property of the authentication is completed.**

**Property of the authentication is com
                                                                                         the controller 40 refers to the signal C2 is one requiring the authentication one ration
                                                                                    necessity table 50, signal C2 table 50, the authentication oberation described below.
                                                                             and starts is one requiring the Specifically, in order to transmit the below.
                                                                    authentication in order to transmit the mobile-station identifier information
                                                               authentication
device 12, the request signal
is read out of the mobile-station identifier

the mobile-station identifier

authentication
identifier

to the network
                                               30
                                                           device (ID) 12, the storage unit 31 and the mobile-station lidentifier information and the random number (R) is genere
                                                     (ID) is read out of the storage unit 31 of the mobile random number denerator 33. The authentication
                                                 by the unit of and the random infinite of an arata and a standom infinite of an arata a standom infinite of an arata and a standom infinite of a 
                                           by the random-number generator 33. The at range the
                                      request authent signal generator 3s station identifier information that contains the mobile.
                   35
                                station identifier signal that contains the metwork device 12
                           station identifier information (ID) and transmits this signal to the transmitter 36. Further, the authentication
                      (R)

Via the transmits this signal to the network device of the authentication operation operation.
                 operation unit ter 36.

Information (K), which is being operation

which is being held by
            operation unit 34 performs the wey-information holding unit 32, and the random
                                                                                                                                                                                                                                          The authentication
      the key information (K), which is being held to authentication result (
the key-information holding unit 32, and the authentication result (X).
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On the other hand, the network device 12 performs the operation indicated by the flowchart on the right side of Fig. 5. Specifically, the mobile-station identifier (ID) included in the received authentication request signal (ID, R) is sent to the home memory 23 to obtain key information (K) identical with the key information being held by the mobile station 11. Next, an authentication operation identical with that of the mobile station 11 is performed using the key information (K) and the received random number (R), and the authentication result (X') is transmitted to the mobile station 11.

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The comparator 39 of the mobile station 11 compares the authentication result (X') received via the receiver 38 and the authentication result (X) computed by the authentication operation unit 34 and outputs a signal (Enb), which allows passage of the rewrite data (Data), to the switch 52 only if agreement between the two results is detected. As a result, the content of memory 53 is rewritten by the data (Data) that has been stored in the temporary storage unit 51.

Thus, by having the mobile station execute authentication processing identical with existing authentication processing executed in a network device, authentication processing on the side of the mobile station can be implemented without using a special setup.

Thus, in accordance with the present invention, when a request to execute an operation is received from a device on the side of a network, control is exercised to execute or not execute the operation upon checking, on the side of the mobile station, whether the request was issued by an authorized base station. As a result, it can be so arranged that implementation of a communication service will not be obstructed wrongfully, and terminal information concerning a mobile station or personal information set by a user will not be used secretly, owing to a request from an unauthorized network device.

40 Further, in accordance with the present invention, control for executing an operation can be carried out on the side of a mobile station upon distinguishing

between a request requiring authentication as to whether a base station that issued the request is an authorized base station, and a request not requiring such authentication.